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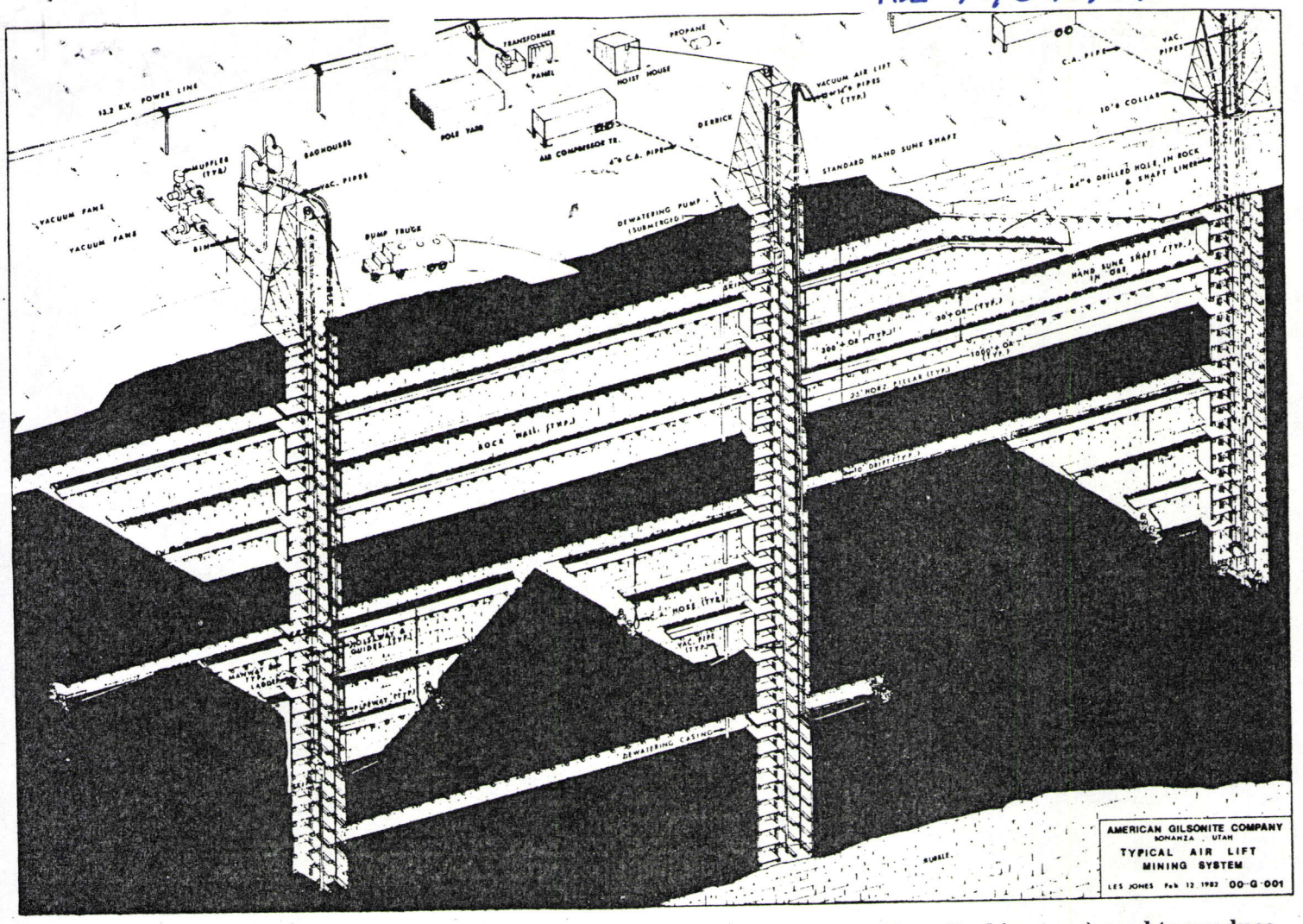


One of the most unusual mining methods in the world is the air lift system (described in story) used to produce Gilsonite in Utah. In effect it is one humungous vacuum cleaner that also provides excellent ventilation.
(Drawing courtesy American Gilsonite Company.)

Uintaite, strange Utah mineral, has many uses

Chevron's American Gilsonite turning out about 35,000 to 40,000 tpy

By Bill Hawes
Field Reporter

For more than a century now, a mighty strange mineral—Gilsonite—has been commercially produced in eastern Utah, the only place in the world that it has been found in meaningful quantities.

The Uinta Basin has an unusual aggregation of hydrocarbon energy resources.

Within this 8,000 square-mile basin are commercial reserves of petroleum, tar sands, oil shale (including the Ua and Ub federal oil shale leases) and Gilsonite.

Gilsonite (a registered trademark of American Gilsonite Company, a subsidiary of Chevron Resources) is perhaps the most noteworthy, for commercial quantities of this strange mineral are found only in this area. (See separate article.)

Gilsonite is a solid hydrocarbon with the mineralogical name of uintaite. It is theorized that vertical fractures in the earth's crust were filled with heavy oil that later lost its volatile constituents and remained in place as a solid. In fact, it is easy to think of it as "solid petroleum."

The Gilsonite mineral is very light in weight, resembles obsidian and has a conchoidal fracture. Freshly mined Gilsonite has an odor similar to fresh tar sands or high-grade oil shale.

Gilsonite occurs in a very pure state, and careful (and unique) mining practices (described below) preserve its purity. It softens, depending on grade, at temperatures between 300 and 400 degrees F. Aside from a low specific gravity, it has high nitrogen and low sulphur content.

From a mining aspect, Gilsonite is unusual in that it occurs in vertical veins, most of which are long and generally very straight. Some veins are as long as 12 miles, with widths varying from inches up to 22 feet.

An interesting history

Gilsonite, or uintaite as it was first called, was discovered by prospectors in the Uinta Basin in 1869. It wasn't until 1885 that commercial development started, led by Samuel H. Gilson of Salt Lake City. Sam Gilson was many things during his colorful life—Pony Express rider, Indian scout and interpreter, U.S. marshall and, above all, an entrepreneurial inventor.

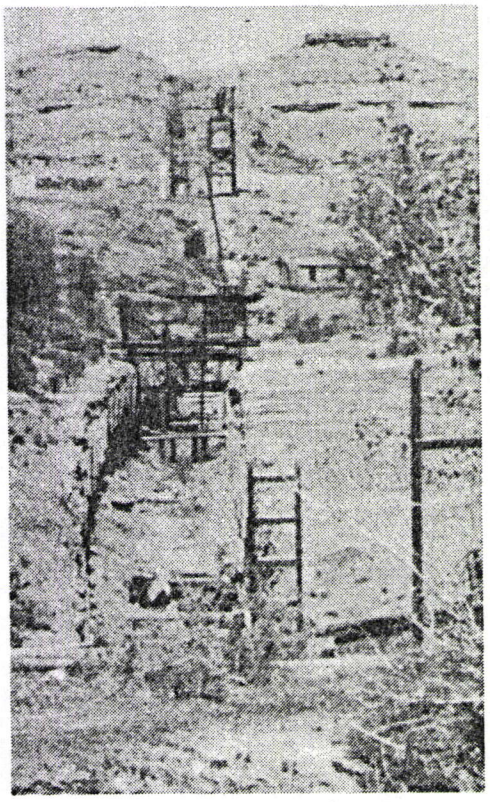
Sam Gilson performed experiments with the unusual material, found uses for it and, not being overburdened with modesty, named it Gilsonite. Patents were issued to Gilson for use of Gilsonite in chewing gum(!), insulation for wires and for a tar-like wood varnish.

In 1888, Gilson and a partner formed Gilsonite Manufacturing Company, which

had the goal of acquiring as many Gilsonite claims as possible and making and marketing the varnish. Over the years, new uses for Gilsonite were discovered and the company grew.

Eventually, Gilsonite Manufacturing became Barber Asphalt Company. This was an important event, as Barber financed construction of a 53-mile railroad to carry Gilsonite to market. Without the railroad, haulage costs would have precluded successful marketing. Construction of the Uintah Railway is in itself a fascinating story. (See "Western Mining Memories" in this issue.)

In 1946, Standard Oil Company of California (now known as Chevron) joined Barber Asphalt to form American Gilsonite Company as a 50-50 venture. This provided for



A depleted vein leaves a long, straight trench.

research funding that found new uses for Gilsonite.

First in synthetic fuels

After much research, a way was found to produce metallurgical coke and gasoline from Gilsonite. As a result, Gilsonsite can rightfully claim to be the country's first successful commercial synthetic fuels project.

A refinery was built in 1957 near Fruita, Colorado to process the Gilsonite into petroleum products and coke. As part of the project, a 72-mile pipeline was constructed to hydraulically transport the Gilsonite from the mines at Bonanza, Utah to the refinery. This pipeline itself represents a significant chapter in development of hydraulic transport.

EDITOR'S NOTE

The author and *PAY DIRT* deeply appreciate the courtesy and cooperation of American Gilsonite in the preparation of this article.

William E. Hawes, author of this interesting report, has been familiar with the Gilsonite operation for many years. The holder of a BS in mining engineering in 1960 from the New Mexico School of Mines, Hawes has 30 years of engineering and operating experience. Included are the seven years, from 1981 to 1988, that he worked for BP America (Standard Oil Company) in Salt Lake City and Cleveland as engineering and mining manager for the company's oil shale and tar sands projects, including the White River Shale Oil Corporation properties near the Gilsonite operations.

By the 1970s, in the era of cheap oil and the absence of federal subsidies for synfuels, producing petroleum products and coke from Gilsonite became marginal to uneconomic. The refinery and pipeline were sold and other, higher-value uses for Gilsonite were promoted.

Current uses for Gilsonite are as an additive to foundry sand, printing inks (*PAY DIRT's* ink contains some Gilsonite), oilfield drilling muds, paints and protective coatings, road paving additives and in various types of building products. Current production is in the neighborhood of 35,000 to 40,000 tons per year, about a tenth of that during the coke-petroleum production time.

In 1981, Chevron purchased Barber's interest in American Gilsonite and has been the sole owner and operator since that time. There are two other uintaite (have to use that name because the other is a registered trademark) producers in the area, but American Gilsonite is by far the largest.

Specialized mining methods

To follow the history of Gilsonite production and uses is to follow the development of several specialized mining methods for safely extracting the mineral, which has a 50 percent higher energy content than coal.

Since the mineral is a hydrocarbon that breaks easily and can produce a significant amount of fines, it is obvious that blasting would be hazardous. Indeed, in 1953 an ignition of unknown origin was responsible for a blast that led to the deaths of eight miners. Following that tragedy, mining methods were changed to hydraulic systems.

During the time of producing Gilsonite as feed for the Fruita refinery, hydraulic methods continued to be used for mining, with high-pressure water used to break the mineral out of the vein. Later, when the product was no longer going to be wetted, the current system of using chipping hammers and pneumatic hoisting was adopted. Using such a method, a two-man team, with a hoistman on the surface, can produce 25 to 30 tons of Gilsonite per shift.

As mentioned previously, Gilsonite occurs in long, straight, vertical veins that can extend as deep as 1,500 feet. The veins are

At American Gilsonite's Bonanza plantsite in eastern Utah, up to 120,000 tpy of Gilsonite can be processed. The product is then stored in different silos according to grade.

Gilsonite . . .

parallel to each other, strike NW-SE and bottom on the Green River Formation, the host to oil shales.

Development begins by sinking shafts on 1,000-foot centers in ore along the vein. If the vein is narrow near the surface, some waste is taken by drilling and blasting. With that exception, the shafts are sunk with chipping hammers and all the material is ore.

The shafts are sunk the width of the vein and 20 to 22 feet along strike to provide three compartments, one each for hoisting, pipeway and manway. The shaft depth, of course, varies with the depth of the vein.

An unusual feature of the Bonanza-area Gilsonite mines is the use of steel oilfield derricks for headframes. They are tied down in front with hoist rope so they won't tip over during hoisting.

Mining starts in the Gilsonite in either direction along strike. Miners work outward using hand-held pneumatic chipping hammers and maintaining a 45-degree angle at the face. This process minimizes contamination of the Gilsonite with wall rock. The walls

Over the years, Gilsonite markets and applications evolve

(EDITOR'S NOTE: From KIRK-OTHMER: ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY, Volume 11, Third Edition, 1980, we have picked out some additional information regarding Gilsonite.)

The only commercially important deposits of Gilsonite in the world are located in the Uinta Basin, in the northeast corner of Utah . . . Elsewhere in the United States, minor deposits of a gilsonlike material have been reported in Wheeler and Crook Counties of Oregon.

Extended geologial work in the Uinta Basin leaves little doubt that the source material was the tremendous oil shale deposits of the contiguous territory, which is further confirmed by certain similarities in the composition of the hydrocarbons involved, ie, both Gilsonite and shale oil have a nitrogen content much higher than petroleum oils in general.

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Until the late 1950s when American Gilsonite Company converted Gilsonite into petrochemicals and conventional petroleum-type products, Gilsonite markets, although worldwide in scope, were limited in volume to applications in which the Gilsonite was dissolved in light solvents or fluxed with vegetable oils and other hydrocarbons as heavy as petroleum asphalt. New and much larger applications began to develop for the unaltered product of the mines and it became obvious that conversion of Gilsonite to fuels in competition with crude petroleum was a poor way to use this unusual natural resource.

At current (1980) price levels, minable reserves are estimated at 5 million tons, with total reserves probably in the range of 10 million to 15 million tons.

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Gilsonite is the raw material preferred by the Nuclear Power Commission in the UK for conversion to nuclear-grade graphite used in British-designed advanced gas-cooled reactors. In early 1980 shipments of Gilsonite commenced in volume to a United States petroleum refinery for conversion to a delayed type coke which, after calcining, is exported to the UK for graphitization and use in two AGR under construction.

Gilsonite is used by the automotive industry, principally in the manufacture of solvent-free seam sealers, although there remains limited use in the production of paints and enamels. During the past 80 years, Gilsonite has been a principal ingredient in dark rotogravure inks and, although lighter-colored inks are now more widely used, the market for Gilsonite in the ink industry continues to increase.

Many applications for Gilsonite, such as its use in battery boxes, floor tiles, molding compoundings and rubber products, have largely ceased to exist. But large quantities now are used by the oil-drilling, foundry, building board, explosive and nuclear graphite industries, in addition to the continuing use by the automotive and ink industries.

It should be noted that the subject report was written by Kenneth R. Neel of American Gilsonite. END

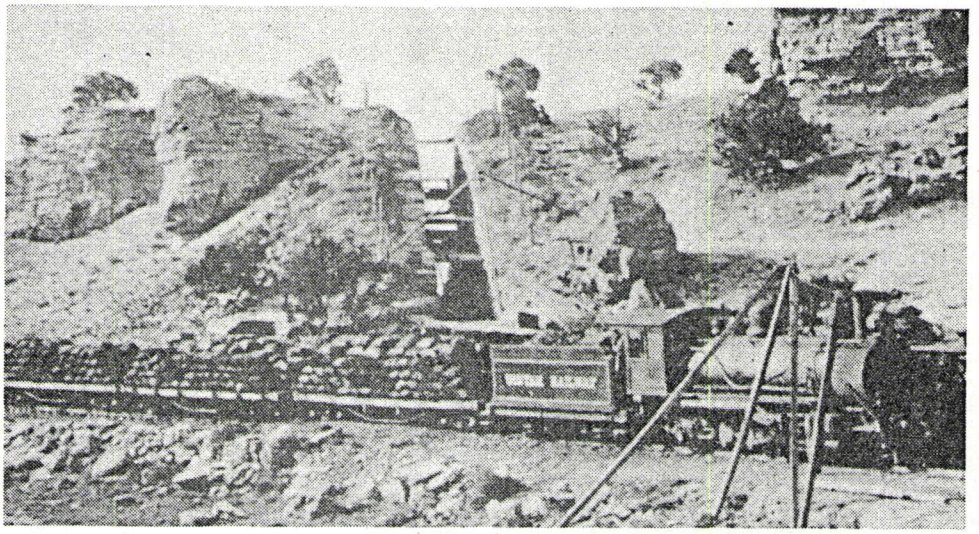
Uintah Railway: crucial link for early-day Gilsonite mines

By Bill Epler
Staff Reporter

Successful commercial development of the Gilsonite (earlier known as uintaite) deposits in northeastern Utah (see Page 4B) shortly after the turn of the century hinged on one factor—transportation.

It was successfully provided by an uncommon railroad, the Uintah Railway, that under most any other circumstance would have been impractical and uneconomic. And to the surprise of many, it continued to operate for many years.

The vertical Gilsonite veins were in the Uinta Basin, a vast, remote and rugged area located near Bonanza, about midway between Vernal, Utah and Grand Junction, Colorado. The brittle, solid asphaltic hydrocarbon mineral was found in vertical veins, 10 to 12 feet wide and up to 2,000 feet deep, that ran for miles across the basin. The material was a good source of printing inks, paints, storage battery cases, asphalt tiles and other commercial products.



A very interesting photo of a train loaded with burlap sacks of Gilsonite, with a mined-out vertical vein in the background. Six carloads were about the maximum for the steep climb over Baxter Pass and down the other side to the connection at Mack, Colorado with the Denver & Rio Grande Western.

Its name was changed from uintaite to Gilsonite in honor of its first commercial producer, Samuel Gilson, a Salt Lake City businessman.

A railroad was the only practical way to B

Western Mining Memories

Gilsonite . . .

A of the mined-out portion are supported with timber, much like in the old days of cut and delayed-fill mining, except that fill is not used.

Scrapers are not used to remove the broken Gilsonite. Rather, it slides down the 45-degree slope to the bottom, from where it is sucked up to the surface with a pneumatic hoisting system, like a large vacuum cleaner, using a 14-inch pipe. On the surface, the ore is discharged into bins for trucking to the central processing plant. The air is filtered prior to discharge into the atmosphere.

One advantage this hoisting system has is that it provides the mine's ventilation as well. Good ventilation is necessary as Gilsonite is considered to be gassy and, as previously mentioned, the Gilsonite dust has a higher energy content than coal dust. This vacuum hoisting-ventilation system keeps the mine virtually dust free.

The vein widths being mined today vary from 1.5 feet to 7.5 feet thick. Each mine, in addition to a hoist and its unique headframe, has a small air compressor to provide compressed air for the chipping hammers and two 100-hp fans for the combined air lift and ventilation.

American Gilsonite recently invested $8 million in a new processing plant with a capacity of 120,000 tpy, considerably larger than is required at present.

Before entering the plant, Gilsonite is separated into bins according to grades, which is primarily determined by the softening-point temperature. Generally, grade will remain consistent within a mine.

Currently, American Gilsonite operates five mines, with the ore from each having a different softening-point temperature. They are 300, 325, 350, 360-370 and 400 degrees

From the receiving bins, the ore is fed into the plant and through a 30-ton-per-hour vibrating-bed dryer for moisture removal. It then is screened according to size and stored in different silos according to grade.

From the silos, the dried, sized and graded Gilsonite is either loaded directly as a bulk product, fed to the bag packer or pulverized. Pulverized material can be loaded directly as a bulk product or packaged through another bulk packer.

More than half of American Gilsonite's production is exported. The company continues to work on ways to extract and process the product more efficiently and to develop new uses for it. END

It is difficult to realize that narrow-gauge trains, including large articulated locomotives, negotiated steep grades and sharp curves, including this 65-degree turn and 7.5 percent grade at Moro Castle. Today, large passenger cars find it a tough climb.

Mining memories . . . Uinta Railway

move large quantities of heavy, bulky products to market in those days. Although that presented a formidable challenge in the Uinta Basin, Gilson's General Asphalt Company and a subsidiary, Barber Asphalt Paving Company, tackled the job.

When neither the Union Pacific, to the north in southern Wyoming and on the other side of the rugged Uinta Mountain range, nor the Denver & Rio Grande Western, to the south of the Uinta Basin, were interested in building the required line of 50-some miles, General Asphalt decided to do it itself.

Wasting no time, the narrow-gauge Uintah Railway was completed in 1904, less than a year after construction began at its connection with the D&RGW mainline at Mack, Colorado, a short distance west of Grand Junction and a few miles east of the Utah border.

And what a road it was! Grades were steep, curves were sharp, and it was a long, hard haul from Mack, elevation 4,550 feet, to the crest of Baxter Pass at 8,437 feet above sealevel. The grade was a bit easier down the other side to the mines near Dragon, but not by a whole lot.

The line over Baxter Pass was unusually steep and crooked for even a mountain railroad. The grades for miles varied between 5 and 7.5 percent. And some of the climbing curves were 65 degrees—meaning that a complete circle would be only 180 feet in diameter!

Operating the railroad called for a number of locomotives, with two or three required to get the short trains over the pass. Conventional rod-driven steam engines were used on the lower sections on both sides of the mountain, but when it came to going over the top the job was turned over to the gear-driven Shay engines—painfully slow but with the power to climb nearly vertically.

Although a passenger car was occasionally included in a train, mostly for company employees, the line was essentially for freight—supplies in and Gilsonite out. Probably because it was handier in those days before mechanization, the Gilsonite was put into burlap bags and loaded aboard flatcars instead of being handled in bulk in gondola cars. Too, the Gilsonite had to be transloaded at Mack from the narrow-gauge cars to the D&RGW's standard-gauge equipment.

Operation of the railroad continued until 1938 when the last of the mines along the line had become uneconomic and were shut down. Most of the Gilsonite operations had moved to new mines and were being handled by truck out of Bonanza.

In 1939, the Interstate Commerce Commission granted approval for abandonment. The rails were taken up for scrap and the rolling stock was sold. The two remaining locomotives were sold to a lumber company in Oregon, where they hauled logs for a few years before being sold in turn to a narrow-gauge line in Guatemala.

Today, more than 50 years later, much of the roadbed is still providing transportation service as a state road, Utah 45.

Of Mines And Men

Copper Range buys mill section from Round Mtn.

Copper Range Company, a Michigan copper producer, has acquired a 6,000-tpd mill section in Michigan from Round Mountain Gold Corporation, a subsidiary of Echo Bay Mines Ltd.

The purchase price was $2 million in cash plus a $2 million note payable due the end of this year.

The mill facilities were acquired a number of years ago when Echo Bay bought Copper Range to acquire its 50 percent interest in the Round Mountain gold property in Nevada. To hold the sale price down, it retained the mill section when it sold Copper Range to a new owner.

The mill section is at the Copper Range concentrator in White Pine, located in Michigan's Upper Penninsula. The section was placed in service in 1967 but had not been operated since 1977.

Included in the facilities are a 14-by-33-foot ball mill, a 13-by-21-foot rod mill, a 13-by 21-foot regrind mill, and 184 cells in primary, secondary, cleaner and recleaner flotation. Some modifications are necessary to conform the section to the current Copper Range mill flow sheet.

Copper Range's total milling capacity will be increasing to about 23,000 tpd, allowing the company to reach a planned operating level of about 20,000 tpd by 1991.

The mill purchase is an integral part of a Copper Range program to increase production and reduce unit operating costs.

Under the program, Copper Range also is purchasing 17 major pieces of high-productivity mining equipment, has made process improvements, has increased its work force to almost 1,100 employees, and has intensified a training program designed to increase competitiveness through productivity increases and cost control. An extensive employee involvement system is an important part of the program.

Copper Range, a wholly owned subsidiary of Metall Mining Corporation of Toronto, produced 92 million pounds of copper in 1989. The mine is expected to produce 112 million pounds of cathode copper this year and to reach an annual rate of more than 130 million pounds during 1992.

Proven and probable ore reserves as of December 31, 1989 stood at 180.7 million tons containing 4.5 billion pounds of extractable copper, sufficient for more than 30 years of production.

Tenneco taps Cunningham

Kenneth D. Cunningham, who joined the company in 1978, has been named vice president of Tenneco Minerals' exploration department in Reno.